The Relationship Between Low Birth Weight and Survival Rate in Premature Babies

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LITERATURE REVIEW
URL of this article: http://heanoti.com/index.php/hn/article/view/hn50207

The Relationship Between Low Birth Weight and Survival Rate in Premature Babies

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ABSTRACT

Preterm birth is a birth that occurs before 37 weeks of gestation where low birth weight is often found at the same time. This combination of low birth weight and preterm has the potential to cause morbidity and mortality. The aim of this study was to study the relationship between low birth weight and survival rate in preterm infants. The research method used is systematic review approach obtained from 7 research studies in various countries and fulfills the inclusion and exclusion criteria. The variables studied were infant birth weight and survival rate using instruments in the form of studies that have been published on Google Scholar, PubMed, and Science Direct. The article search method uses the characteristics of PICO (Population, Intervention, Comparison, Outcome), then the data in the form of articles that have been collected is managed using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method. From the 7 articles that were reviewed, it was found that the lower limit of the survival rate in the ELBW category studied was 30.8%, 20.5%, 34.8%, 7%, 69.6%, 58.5%, and 59%. Then at the upper limit in the VLBW and LBW categories, numbers such as 91.8%, 95.6%, 84.8%, 92%, 97.9%, 95%, and 98.1% are obtained. There are consistent results, namely an increase in the survival rate with increasing birth weight, which shows a significant relationship between the two.
Keywords: preterm; survival rate; low birth weight

INTRODUCTION

Indicators of child-related mortality are the Neonatal Mortality Rate (NMR), Infant Mortality Rate (IMR), and the Under-five Mortality Rate (UMR). According to SDKI, in 2017, the infant mortality rate decreased for IMR by 15 per 1,000 live births, IMR 24 per 1,000 live births, and UMR 32 per 1,000 live births[1]. The trend continues to decline from 1991-2017[2]. But preterm births continue to increase every year[2]. According to the WHO, 1 in 10 babies are born preterm[3]. Prematurity becomes the cause of death in infants in the first 4 weeks of life, number 2 after pneumonia in children under 5 years of age, and is an important cause of death in the first month of life. Many survivors have disabilities in their lifetime. In 2010, the WHO ranked countries by premature birth rate above 15% and Indonesia ranked 9th out of 11 countries[3].

A preterm birth is the birth of a live baby that occurs before the gestational age reaches 37 weeks[3]. While Survival Rate is the percentage of people in a study group or therapy who are still alive for a certain period of time after being diagnosed or starting therapy for a particular disease[4]. The National Institute of Child Health and Human Development (NICHD) in mid-to-late 1980 performed survival rate calculations on preterm birth infants including Extremely Low Birth Weight Infant, a live birth weighing less than 1000 grams or 1 kilogram where a significant survival rate increase was obtained as the increase of 100 grams in birth weight and gestational age that began less than 23 weeks to 28 weeks.

In 2018 study by Abolfotouh et al, when the association of survival with birth weight or with gestational age was compared to using logistic regression models, it was found that birth weight is a significant predictor of infant safety compared to gestational age[5]. Preterm birth and SGA (Small for Gestational Age) conditions that are the cause of Low Birth Weight (LBW) are also important causes of neonatal death. LBW contributes to 60% to 80% of all neonatal deaths. The global prevalence of BBLR is 15.5% which means about 20 million BBLR babies are born each year and 96.5% of them are born in developing countries. Therefore, researchers conducted

systematic review studies to prove a link between low birth weight and survival rate in babies born prematurely in the hope that it can be a consideration in postnatal care when existing resources are limited.

METHODS

This study used a systematic review approach in which all variable data were collected from previous studies. Articles were taken according to the inclusion and exclusion criteria of 173 studies. The exclusion criteria were studies that examined babies born more than 37 weeks and having a birth weight of more than 1500 grams. While the inclusion criteria were the ones that examined babies born at gestational age less than 37 weeks and had birth weight less than 1500 grams. The variables studied were survival rate when the baby was discharged from the NICU and birth weight of premature babies.

RESULTS

Literature Search

Literature searches were carried out on three different databases, namely: Google Scholar, Pubmed and Science Direct. From the three databases, 174 studies were found using the keywords preterm baby, low birth weight, and survival rate. Of 173 studies, we got 167 studies after eliminating duplication. The study was evaluated through reading the title and abstract and found 51 studies that could potentially be used in this review. After eliminating studies based on inclusion and exclusion criteria, 7 studies that meet the inclusion criteria were included in this Systematic Review. The diagram for this process can be seen in Figure 1 which shows the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) used for the selection of studies that can be used for this research.
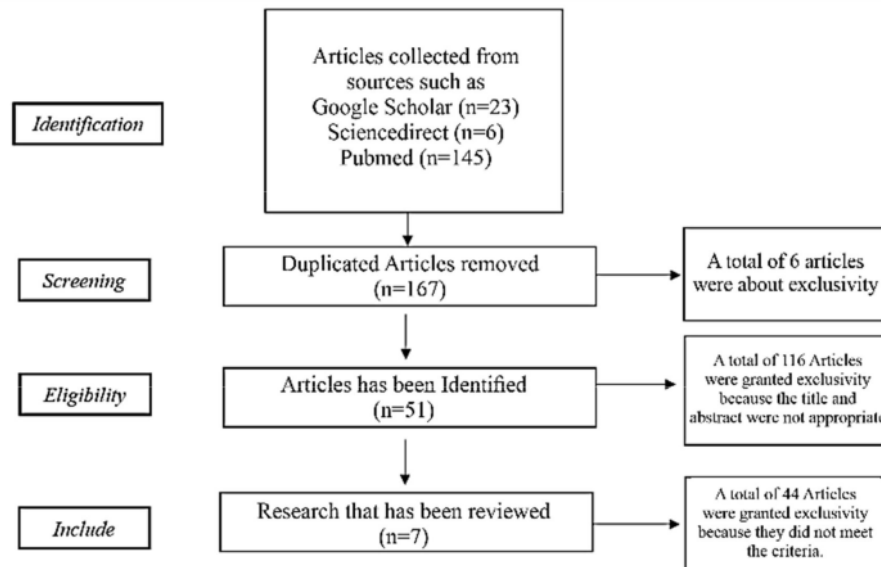
Figure 1. Diagram of preferred reporting items for systematic review and meta-analysis (PRISMA)

Research Characteristics

Researchers used data from 7 research articles that had been preselected with research categories that had data on the relationship between low birth weight and survival rate in preterm birth infants. All articles studied used different research designs. There are 4 analytical observations with 3 cross-sectional approaches and 1 prospective/ retrospective cohort approach. The remaining 3 observational books are with a cross sectional approach. In addition, researchers on each research article also collected data on the country and year of birth of preterm babies. Variable data is collected through primary and secondary data. Primary data is obtained by following up babies with preterm and LBW criteria. While secondary data is obtained through medical records. The research time of each article was conducted in the last 6 years, namely from 2014 to 2020. A total of two research articles were conducted in 2018, 2 research articles were conducted in 2017, one article was conducted

in 2015, one article was conducted in 2016 and one article was conducted in 2014. The research locations of all articles are conducted in various countries. The study subjects in each research article were the same as babies born under the age of 37 weeks period with a birth weight of <2500 grams.

Preterm Incidence, Low Birth Weight, and Survival Rate

Although measurements of prematurity and birth weight are carried out in different countries, the definition used refers to the WHO. All babies included in this study have been treated in the NICU. Survival rate calculation in all studies refers to the percentage of the number of babies alive from the entire baby born in a certain period according to their respective studies.
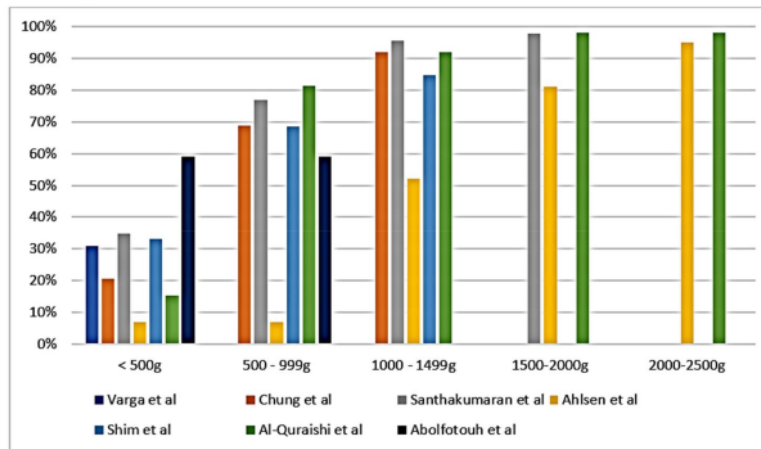

Figure 2. Comparison between studies

The similarity between all the studies in figure 2 is the survival rate assessment conducted in 2000 and above where the technology is different from previous times. Gestational age is largely uncategorized because when studying weight, researchers tend to discuss weight alone. In the study, the defined survival rate is the percentage of life of babies who died from birth to discharge from the NICU.

In the calculation of ELBW survival rate, a number that varies but still correlated and influenced birth weight. Since ELBW is defined as birth weight below 1000 grams, some studies divide it again by categories <500 grams and 500–999 g. It can be quoted from varga et al., study that examined the survival rate in babies with birth weight <500 g obtained 30.8% on 2006-2010 and 70.4% on 2011-2015[6]. Then in Chung et al.,'s study, obtained survival rate in ELBW categorized infants with a weight below 500 grams of 20.5% in 2000 and 31.7% in 2010[7], and mentioned in the study Santhakumaran et al., obtained a figure of 34.8% for babies with birth weight <500 grams[8]. mong the studies in the ELBW category, the lowest figure was found to be the lowest in the Ahlsén et al., study of 7% but the figure represented <1000g, not divided into 2 categories[9]. In the Shim et al. study[10], we obtained ELBW survival rate data <400 grams is 33.3% and 400-499 grams is 40%. The study by Al-Qurashi et al, presented data with a range of 200g, obtained data with the lowest birth weight with a range of 400-599g with a survival rate of 15.4%.[11].

Followed by a weight of 500 grams — 999 grams in the study Shim et al., obtained a gradual increase as the weight rose 100 grams, starting from 500-599 grams the survival rate was 47.1%, 61.6% (600-699 grams), 68.6% (700-799 grams), 82.2% (800-899 grams) and 82.8% (900-999 grams), then taken overall obtained the figure of 69.6% (<400-999 grams) for the category ELBW[10]. In Chung et al.,'s study, the figures obtained were 68.8% in 2000 and 73.3% in 2010[7]. Then in the study al-Qurashi et al., obtained the figure of 66.7% for 600-799g and 81.3% for 800-999g, and concluded with a range of 400-999g in this study, the survival rate was 58.5%[11]. In the study Santhakumaran et al., the survival rate for 500-900g is 76.8%[8]. Lastly, in a study by Abolfotouh et al., they received 59% in the ELBW category[5].

Furthermore, the survival rate of infants with birth weight 1500g-1000g is the highest. From Shim et al.'s research, mentioned the result of survival rate calculation in VLBW category is 91.9%, 93.7%, 92.7%, 96.8%, and 97.9% for birth weight 1000-1099g, 1100-1199g, 1200-1299g, 1300-1399g, and 1400-1499g. When the figure is obtained, it is 84.8%[10]. For Varga et al., no data was obtained because their study was only for <500g[6]. Then the study by Al-Qurashi et al., mentioned the survival rate for 1000-1499g is 92%[11]. In Chung et al.,'s study,

presented two survival rate figures for the 2000s consisting of 2002, 2007, 2009 and for the 2010s consisting of 2013, 2014, 2015, and the survival rates for 1000-1499g were 91.8% and 95.2%[7]. The study conducted by Ahlsén et al., found that 52% of VLBW survival rates were the result of a total of 2 hospitals in Malawi[9]. The two hospitals have problems such as staff shortages, poor use of CPAP machines, and lack of resource issues. From Santhakumaran et al. study, we obtained a survival rate of 95.6% for VLBW[8].

The Shim et al. study, Varga et al., Chung et al., and Abolfotouh et al., did not measure survival rates in the <2500-1500g (LBW) category. In the study Ahlsén et al., was presented to be 2 in the LBW category, namely 1500-1999g and 2000-2499g. Obtained numbers respectively 81% and 95%, or when made 1 with a range of 1500-2499g obtained 90%. From the study of Al-Qurashi et al., we obtained the figure of 98.1%. Then in the study by Santhakumaran et al., they obtained 97.9% for LBW with a range of 1500-1999g.

DISCUSSION

Preterm Incidence, Low Birth Weight, and Survival Rate

Research articles that the researchers studied predominantly show high preterm birth rates with low birth weight. This means that the combination of 2 conditions of preterm and low birth weight is still a serious problem that threatens infant mortality and morbidity.

Obtained in one research article by Ahlsén et al., conducted in Malawi, where the survival rate is still very low compared to research with the same category. This condition is caused by hospital resources that are still very lacking, such as the absence of specialist doctors in the hospital, not routinely use tokolitik to prevent preterm birth and the availability of antenatal corticosteroids and antibiotics are not guaranteed. Other conditions such as delayed skin-to-skin contact, simple CPAP units only amount to 1 piece, mechanical ventilation and surfactant are not available[9]. But it should also be remembered that the study by Ahlsén et al., is the only study conducted not in developed countries, but rather according to ISGE 2018 including the developing country, namely Malawi. When sorted specific to developed countries, research by Al-Qurashi et al., conducted in Saudi Arabia has the lowest survival rate in the ELBW category of 15.4%[11]. The research used is also different years there are 2 studies in 2018, 1 research in 2014, 2 research in 2017, 1 research in 2016, and 1 research in 2015.

Birth weight is regulated by two major processes, namely duration of containing and intrauterine growth rate. So LBW is caused between short pregnancy or slow intrauterine growth or a combination of both[12]. Premature babies, especially those born less than 1500g have a higher risk of conditions such as hyaline membrane disease, apnoea, intracranial haemorrhage, sepsis, retrolentalfibroplasia and other conditions related to physiological immaturity[12]. However, as quoted from research by Al-Qurashi et al., the trend of survival rate in premature babies continues to show progress, this can occur due to the appropriate development of antenatal and neonatal intensive care concepts regarding the implementation of strict policies and procedures, infection control measures, and the evolution of applied medical practices over the last 2 decades.

The Relationship of Birth Weight with Survival Rate in Premature Babies

Data from 7 studies that have been studied shows that birth weight is a factor related to survival rate, as quoted from Abolfotouh et al., when the association of survival rate with birth weight, gestational age, researched using logistic regression model obtained birth weight results are a significant survival predictor (p = 0.001) while the gestational age is not (p = 0.6). But this does not mean that the gestational age has no effect. In the Shim et al., study, the results of survival rate increase as birth weight and gestational age increase. In the study al-Qurashi et al., also obtained results of babies born weighing 400-599g. Babies born weighing 400-599g have a survival rate of 15.3%, while those born with a birth weight of 800-999g obtained a survival rate of 81%, almost 4 times more than those born with a birth weight of less than 600g. According to a study conducted by Vazirinejad et al., mentioned results from multivariate logistic regression showed that birth weight has the greatest effect (beta = 0.501) among other variables studied (maternal age, maternal work, maternal residence, maternal education status, birth order, and baby sex) in determining the survival rate of the baby[13]. In a study by Haghighi et al., also mentioned neonatal survival rates drastically influenced by birth weight, especially below 1000g[14]. The percentage difference in each study occurred due to socioeconomic and year differences, in which the year signifies advances in technology and health sciences. In Chung et al.,'s study, increased significantly from 83.3% in the 2000s to 85.8% in 2010s in the VLBW category (P < 0.8% 66.1% in the 2000s and 70.7% in 2010s in the ELBWs category (P < 0.001). As quoted from a study by Varga et al., in 2010 there were 3 protocols that were changed as health sciences developed such as changing from a rescue regimen to a prophylactic surfactant administration, changing the initial dose of alpha poractant from 100 mg/kg to 200 mg/kg, and infants with patent ductus arteriosus conditions were given ibuprofen treatment from indomethacin. As for socioeconomic means that the treatment in each hospital and country varies depending on socioeconomic conditions, and other factors such as political differences[10].

In developing and developed countries, birth weight is one of the most important factors affecting neonatal mortality. Birth weight is also a significant determinant of post-neonatal mortality and morbidity in childhood[12]. Worldwide, neonatal mortality was 20x greater in LBW compared to babies who weighed more than 2500g[15]. In addition, low birth weight is also associated with long-term neurologic disability and impaired language development[16]. Preterm infants are at additional risk due to the imaturity of the organ systems, including intracranial hemorrhage, respiratory distress, sepsis, blindness, and gastrointestinal disorders[17].

CONCLUSION

Based on the results obtained from the processing of research data, it was concluded that there is a significant relationship between Birth Weight and survival rate in premature babies.Innovations that can be adapted from this study is the creation of a national-based database system of medical records of premature babies consisting of conditions, risk factors, and complications of mother and baby as well as the treatment that the baby receives when the NICU until the baby discharges, and the condition when exciting the NICU.The database will be accessible to doctors throughout Indonesia. This is expected to facilitate the research or development of science on this topic of prematurity. Thus, it is expected that infant mortality and morbidity can be lowered.

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